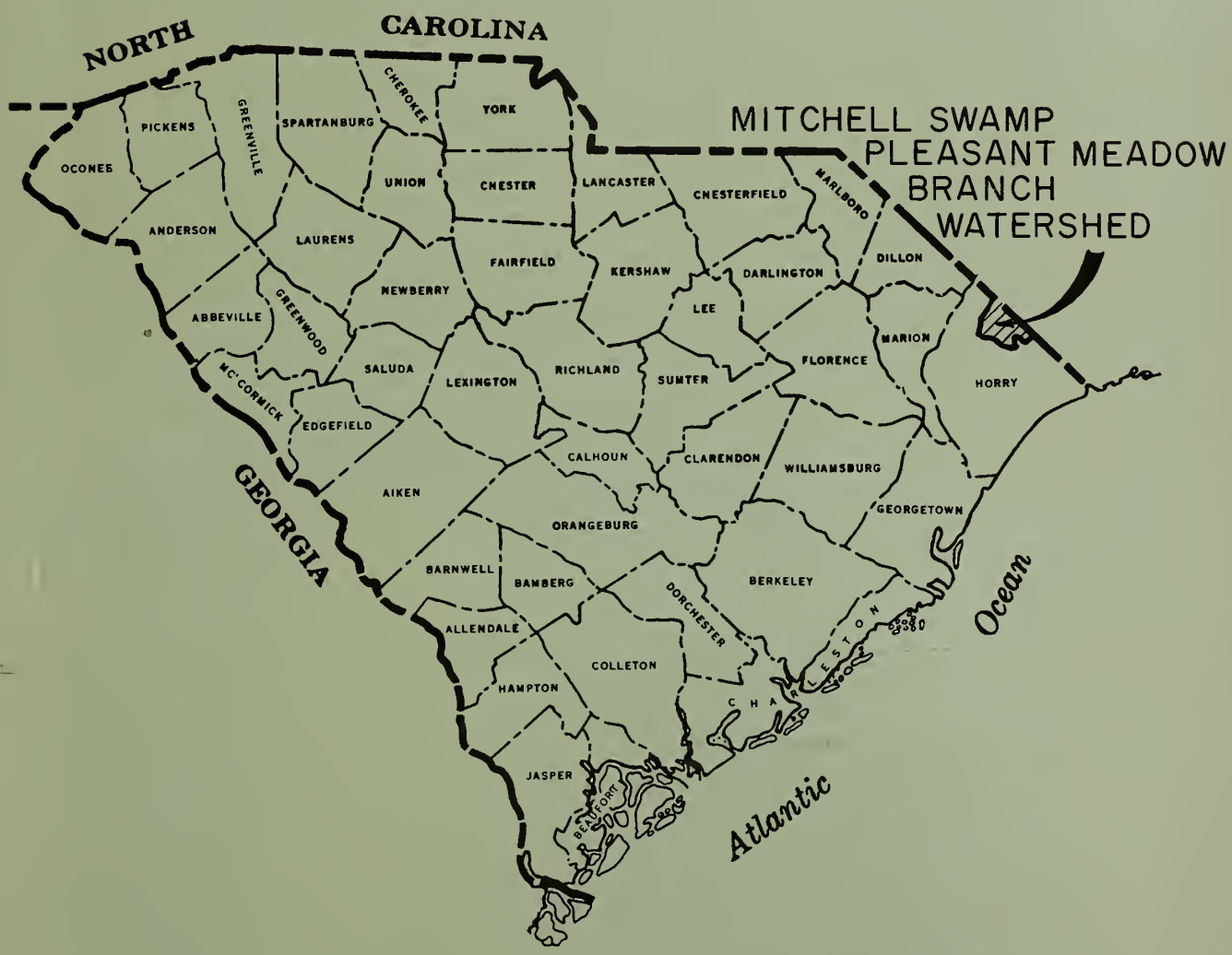
WATERSHED WORK PLAN

MITCHELL SWAMP-PLEASANT MEADOW BRANCH WATERSHED

HORRY COUNTY

SOUTH CAROLINA



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AUGUST 1964

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HORRY COUNTY

SOUTH CAROLINA

Prepared under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, 68 Stat. 666) as amended.

Prepared by: Horry Soil Conservation District
Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District

With Assistance By:

U. S. Department of Agriculture, Soil Conservation Service

U. S. Department of Agriculture, Forest Service

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HORRY COUNTY, SOUTH CAROLINA

+ SUMMARY OF PLAN

The Mitchell Swamp-Pleasant Meadow Branch Watershed has an area of 67,332 acres and the greater part is located in Horry County, South Carolina. A smaller portion, consisting of 5,104 acres is located in Columbus County, North Carolina. It is situated in the Atlantic Coast Flatwoods which lies in the Atlantic Coastal Plain physiographic province. The sponsoring local organizations are the Horry Soil Conservation District and the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District.

The land in the watershed is privately owned and farms vary from a few acres to several hundred. Land use is as follows: woods, 47 percent; crops, 45 percent; pasture and idle, 7 percent; and miscellaneous, 1 percent.

The main problems in the watershed result from flood damage and a lack of outlets for drainage and floodwater. Crops, pastures, roads and bridges are flooded regularly causing significant damages. Present drainageways are located in swamps which are of insufficient depth to provide adequate outlets for farm drains. Other problems include wind erosion in cultivated fields, mosquitoes resulting from present wet conditions, and the redevelopment needs of the low-income families.

The principal obstacle to installing land treatment at present is the lack of outlets for on-farm drainage. Present conservation efforts are hampered because basic drainage and flood prevention cannot be installed on farms. These outlets will be provided by the structural measures planned for this watershed.

Land treatment measures will include conservation cropping systems, cover and green manure crops, wind stripcropping, rotation grazing, pasture planting, wildlife habitat development, tile drains, drainage laterals, drainage field ditches and forest land improvement.

Land treatment is estimated to cost $1,871,293. Of this, $146,247 will come from PL 566 funds and the remaining $1,725,046 from other funds (see Table 1).

Structural measures planned for the watershed include 38.67 miles of multiple purpose channel for flood prevention and drainage. The estimated cost is $984,409, of which $723,014 will be paid from PL 566 funds and $261,395 from other funds (see Table 1).

Present damages in the watershed result mainly from frequent floodwater and poor drainage. The greater part of this water damage is to cultivated crops. Some damage results from wind erosion.

Installation of the planned structural measures will benefit 57,232 acres of land. These benefits will accrue on lands of 697 farms.

Redevelopment benefits will affect the entire watershed by increasing income.

A comparison of benefits and costs in the proposed watershed project results in a 3.9 to 1.0 benefit-cost ratio. The estimated average annual project

benefits, excluding secondary benefits, are $239,530 and the average annual cost of the works of improvement will be $61,545.

This project will make a significant contribution to needed land use adjustments, will increase farm efficiency and will contribute to community development.

Structural measures will be installed under contracts administered by the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District. The local share of the cost will be obtained through a loan from Farmers Home Administration. This will be repaid from tax levies already voted on favorably by the landowners of the District. The Watershed District has taxing powers sufficient to meet its obligations.

The Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District has assumed the responsibility for operation and maintenance of the structural measures. Land Treatment measures will be maintained by the landowners in conjunction with their conservation farm plans made with the Horry Soil Conservation District.

DESCRIPTION OF THE WATERSHED

Physical Data

Location - The Mitchell Swamp-Pleagant Meadow Branch Watershed comprises an area of 67,332 acres. Of this, 62,228 acres are located in South Carolina, and the remaining 5,104 acres are in Columbus County, North Carolina. Only the portion in South Carolina is in the organized watershed district. The part in North Carolina is largely in woodland and the North Carolina landowners are not participating in this project. The structural measures provided in this work plan will give the existing system of channels in North Carolina a much better outlet. An additional drainage area from Playcard Swamp (11,200 acres) enters the watershed near the lower end. The landowners in this drainage area requested that they not be included in the organized district. The Town of Loris, South Carolina and a portion of the Town of Tabor City, North Carolina lie in the watershed. The City of Conway, South Carolina is located about fifteen miles southeast of the area.

Climate - Long term mean temperatures for this area are 48°F and 81°F for the months of January and July; and 64°F for the year. Long term mean precipitation ranges from a low of 2.45 inches in October to a high of 6.96 inches in July. The mean annual precipitation is 48.99 inches. The average growing season is 233 days, and the average date of the last killing frost is March 22.

Physiography and Geology - The watershed is located in the Atlantic Coastal Plain physiographic province some twenty miles inland from the present shoreline The area is underlain by a thousand feet or more of upper Cretaceous sediments which overlie the crystalline basement. Immediately underlying the area is the Pee Dee formation, which in this vicinity is several hundred feet in thickness. The Pee Dee formation consists of fine to coarse sands and sandy marls with interbedded thin layers of hard marl rock or coquina. The Pee Dee does not crop out in the immediate vicinity, since it is capped by a mantle of Pleistocene sediments which may be as much as several tens of feet in thickness and which consist of sands and clay. The sands here are very fine, like beach sand, and suggest that the sediments are marine although they are non-fossiliferous. Elevations above mean sea level would indicate most of the area to lie on the Wicomico terrace. Occurrences of more pronounced relief and lower elevations in

some vicinities suggests that the line of the scarp separating the Wicomico and Penholoway terraces passes through the watershed with the land at lower elevations lying on the Penholoway terrace. Drainage is through broad, flat swamps. In general, there is a more or less well-defined major channel but there are places where intricately braided small channels obtain and others where channels are almost without definition. In general, the land is almost flat and relief becomes somewhat more pronounced as the lower end is approached. The principal drainageways in the watershed, do not provide adequate outlets for adjacent lands except during dry times when needs are not critical. Long Branch, Iron Spring, Huggins, Mitchell, Pleasant Meadow and Lake Swamps readily become filled with water when there is rainfall. Due to dense vegetation and the nearly-flat gradient, the water recedes very slowly, often remaining in the swamps for weeks or months. This condition at present makes these swamps unsatisfactory as year-round outlets. The difference in elevation between field level and bottom of drainageway varies from one to five feet. Elevations in the watershed vary from 107.0 (m.s.l.) on State Highway 701 south of Howard to 43.0 (m.s.l.) in Lake Swamp near the lower boundary.

Soils - The soils of the area were derived from unconsolidated sands and clays. The principal soil series are Lynchburg, Dunbar, Goldsboro, Klej, Coxville, Portsmouth, Rains and Rutledge. There are small areas of Norfolk, Lakeland, and alluvial soils. These soils are nearly level and are on broad flat areas. The well-drained Norfolk and Lakeland soils occupy the low ridges between drainageways.

Only fifteen percent of the soils of the watershed are well drained. The remaining 57,232 acres are classed as "w" land indicating a need for drainage. This land is also subject to flooding. About 61 percent of the "w" land has been placed in classes IIw, IIIw, and IVw. When properly drained and protected from flooding, these soils have good agricultural capabilities and are responsive to good management.

Soils in the natural drainageways are generally very heavy and will not cave or slough when sides are vertical or near-vertical. Old ditches cut in this manner in the past have not given any sidewall trouble.

Land Use and Cover - Land use within the watershed includes 30,000 acres of cropland, 31,448 acres of woods, 4,884 acres of pasture or idle, and 1,000 acres of miscellaneous.

Cover on the cultivated land is generally fair. It ranges from good in fields planted to grain or soybeans to poor for those in tobacco. Cover in the woodland is classed from poor to very good. On pasture, it varies from fair to good. Cover on the idle and miscellaneous land varies over wide limits.

Water Courses - The dendritic drainage pattern, with flow in a general southerly direction, is characterized by ill-defined channels and drainageways in most reaches. Discharge is into Little Pee Dee River some ten miles southwest of the lower watershed boundary.

Forestry - Like the open land, the forest land is generally flat. The soils range from well-drained sands to waterlogged clays. The principal soil series in the wooded areas include Norfolk, Klej, Leon, Plummer, Rains and Bladen.

The upland forest types are pine, 92 percent; hardwood-pine, 2 percent; and hardwood, 6 percent.

Twenty-three percent of the forest land is medium to pooly stocked with merchantable tree species. The hydrologic condition of the forest is: 13 percent, very good; 30 percent, good; 34 percent, fair; and 23 percent, poor.

Fish and Wildlife Resources - Because of the varied ecological conditions in the watershed, most of the wildlife species common to South Carolina may be found in the area. Bobwhites, dove, rabbit, and squirrel are important resident game species. Wood duck is the principal waterfoul species. In the past there have been deer and a few flocks of wild turkeys in the project area but heavy hunting pressure and human population density have been limiting factors.

The value of fur bearers for pelts is negligible. The present market demand for pelts is too small to make trapping profitable. Hunting of raccoon and opossum is a popular sport, however, farmers consider the large raccoon population a nuisance. A few otters occur and there is some sporadic trapping, principally around farm ponds. Mink are rare and the pelts are of low quality. Muskrats do not occur.

Non-game birds are abundant in a wide variety of species.

All species of freshwater fish common to the coastal plain are found in the swamp runs. The value of the natural waters for fishing in the project area, however, generally is of a low order but the natural swamp lakes and potholes at times provide good fishing. Most likely the swamp area would be more intensively used by fisherman were it not for the difficulty of access.

Economic Data

Farms in the watershed vary in size from only a few acres to several hundred. The typical farm contains an area of about 97 acres. Alloted crop acreage for tobacco affects farm market values more significantly than all other factors. It is estimated that the present market value of farm land, including woodland, open land, buildings and improvements, ranges from $450 to $550 per acre. There are 697 farms in the watershed and most of them are operated by owners.

Markets are easily reached by highways and roads. Most of the farm products are marketed within short distances from the watershed.

Principal crops produced, in order of importance to the economy, are tobacco, corn, sweet potatoes, soybeans, timber products, cotton, pasture grasses, truck crops and small grain. It is estimated that ninety-two percent of the income in the watershed is from agriculture.

There are no National Forest or other public land ownerships in the watershed. The forest land is all in small private holdings. The 31,448 acres of woodland are about equally divided between swamp sites and higher upland areas.

The South Carolina Commission of Forestry, in cooperation with the U. S. Forest Service in the various Federal-State cooperative forestry programs, is providing forest management assistance, forest fire prevention, and suppression, distribution of planting stock and forest pest control assistance to private landowners in the watershed.

Horry County was designated a Rural Areas Development county under the Area Redevelopment Act of 1961. It is expected that farm income in the watershed will be greatly improved by the project since a very high percentage of the total income is from agriculture.

The 1959 U. S. Census of Agriculture, adjusted, shows that 80 percent of the farms in the watershed are listed as commercial. This is higher than most counties in South Carolina because Horry County ranked first in the State and third in the Nation in tobacco production by county in 1960. This indicates that 20 percent of the farms in the watershed are non-commercial and had total sales of less than $2,500.

Other census data on commercial farms, adjusted, divides them into six economic classes on the basis of the total value of all farm products sold as follows:

Class of Farm	Value of Farm Products Sold	Percentage of Farms By Economic Class in Watershed
Class I	$40,000 and over	0
Class II	$20,000 to $39,999	1
Class III	$10,000 to $19,999	13
Class IV	$5,000 to $9,999	33
Class V	$2,500 to $4,999	38
Class VI	$ 50 to $2,499	15

These data show that 15 percent of the farms in the watershed had total sales of less than $2,500 even though classified as commercial.

WATERSHED PROBLEMS

There are 57,232 acres of land in the watershed that have both water

management and flooding problems. On these lands the two problems are inseparable.

Floodwater Damage

Natural channels of low capacity and a water table close to the land surface are characteristic of this watershed. As the lower boundary of the watershed is approached from the upper portion, the depths of the natural drains increase somewhat. However, in winter, early spring and at other periods of intense rainfall, these swampy areas tend to fill with water which reduces storage and flowage possibilities. Consequently, a large percentage of the watershed is subjected to frequent flooding. There are 24,800 acres of land in the watershed that are flooded on an average of two to three times annually. This condition limits present intensive cultivation involving high-return crops to the very highest land. Artificial means of removing surface water are necessary to reduce the extent and duration of flooding so that more of the land may be utilized more profitably. Some public roads in the watershed are flooded regularly. This results in inconvenient detours and expensive road and bridge repairs.

Agricultural Water Management

Much of the land subject to flood damage needs drainage also for most economical production. This land is mostly in capability classes IIw, IIIw and IVw with smaller amounts in other "w" classes. While most of the farms have an on-farm drainage system, these facilities are generally not sufficient because of inadequate outlets. About eighty-five percent of the soils in the watershed bear the "w" or "wet" classification.

Yields and quality of crops from improperly drained areas are substantially lower than on well drained areas of the watershed. Poor crop stands and inability to perform proper cultivation cause low yields. Abnormally wet soil conditions also prevent the operation of farm machinery during harvest seasons which results in increased crop costs.

The problem of drainage and flooding are invariably present on the same land. In the upper portions of the watershed where no definite drainage pattern is present, outlets are not available causing flooding and drainage related problems. In the lower areas of the watershed where natural waterways are in depressed swamps, a similar problem exists after periods of intense rainfall. Water standing in these drainageways reduce carrying capacity and storage. This causes backwater in the existing channel systems which results in poor drainage and inadequate removal of floodwater.

WATERSHED PROBLEMS

SC-2050-8

Damage to tobacco caused by flooding from a ten to twelve-inch rain in 14 hours on June 6, 1964.

SC-1973-7

Flooding in pasture caused by rains in March 1964.

WATERSHED PROBLEMS

SC-1973-5

Pasture and road flooded by rains in March 1964.

SC-1973-1

Typical damage to tobacco beds caused by flooding from nearby swamps.

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Health Conditions

The large amount of standing water and the moist conditions in the water-whed are both conducive to the breeding of mosquitoes. The high water table and frequent flooding are detrimental to the proper functioning of septic tanks.

Erosion Damage

Wind erosion is significant and requires some control in the larger fields. Moderate sheet erosion is occurring in the areas along the swamp drainageways where slopes become slight. Sediment damage is of little consequence.

PROJECTS OF OTHER AGENCIES

There are no existing or proposed works of improvement which would affect or be affected by the structural works of improvement to be installed by this project. The Horry Soil Conservation District, The South Carolina State Forestry Commission, The State Extension Service, the Farmers Home Administration and the Agricultural Stabilization and Conservation Service will all help farmers with the application of land treatment measures.

One hundred and eleven basic farm conservation plans have been prepared by landowners in cooperation with the Horry Soil Conservation District and eighteen of these have had all conservation measures installed. It is planned that the watershed program will be coordinated with all going programs to facilitate the accomplishment of the project objectives.

BASIS FOR PROJECT FORMULATION

The objectives of the sponsoring local organizations included the application of necessary land treatment and a canal system to provide main outlets in the watershed for a five-year level of protection against flooding to permit the production of tobacco and other high-value crops, and drainage with enough depth to accomodate drain tile.

The watershed directors indicated where they desired the main outlets to terminate at the upper ends.

Possible alternate plans were considered and it was found that in certain areas of the watershed, the existing depressed swamps could be used to carry a portion of the required flow without damage to cultivated fields and without lowering the desired levels of protection. The Watershed Directors accepted this plan and agreed to the indicated cost-sharing.

Drainage requirements were based primarily on the needs of bright leaf tobacco. Other crops were considered but they were secondary. No emphasis was given to draining woodland areas.

To accomplish the project objectives a constant of 69 in the formula $Q = CM^{5/6}$ was required. This results in the removal of 4.70 inches of precipitation in 24 hours from a one square mile area. A constant of 45, in the above formula, was used in certain areas where there was sufficient natural storage in the swamp to permit use of this constant.

After considering distances and gradients, it was decided that a depth of seven feet would be a good average figure to use in designing channels so that an adequate outlet would be provided for drain tile systems.

No project measures are planned for that portion of the watershed in North Carolina. This will not have any adverse affects on the project. The planned works of improvement shown on project map are designed with sufficient capacity to provide for future development of the 5,104 acres in North Carolina which drains naturally into Huggins Swamp.

Possible damage by drainage channels to tupelo gum stands in the swamps of the watershed was studied by representatives of the U. S. Forest Service and the South Carolina State Forestry Commission. Only a small amount of this species was found in the watershed and since it is planned for the swamps to carry a portion of the designed channel capacity, resulting in periodic overflow of the channel, which will keep the moisture content of the swamp high, damages to this species were deemed to be negligible.

Damages to fish habitat were studied and it was agreed that the course and alignment of the channel should be varied so as to miss as many as possible of the existing lagoons and natural lakes which now exist in the swamps of the watershed. This plan will help reduce losses to the fishery resource. The spoil from channelization will provide a much easier access to fishermen.

The possibility of increased flooding below the lower watershed boundary in Lake Swamp was studied. Flood routings in that area indicate very little increase in stage on account of the proposed watershed works of improvement. Because of the width and capacity of Lake Swamp in this area, it provides an adequate outlet for the project.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

The objectives of the Mitchell Swamp-Pleasant Meadow Branch Watershed are watershed protection, flood prevention, and agricultural water management. An effective land treatment program must be applied to the land if these objectives are to be met.

About sixty-one percent of the land in the watershed is in IIw, IIIw and IVw classes. This is very desirable farm land but needs flood prevention, drainage, and other conservation practices.

The differences in soils and topography clearly indicate the need for planning and applying an intensive land treatment program that will control runoff and erosion, provide better drainage and improve soil conditions. In selecting land treatment measures, consideration was given to the type and intensity of conservation problems, overall project objectives and the type of farming being followed in the area. In developing conservation farm plans landowners can utilize alternative combinations of measures which will not only help accomplish project objectives but will also be consistent with their individual needs and desires as well as their physical and economic resources.

In order to apply an effective land treatment program, a thorough conservation farm planning job must be done. A study of conservation needs showed that at least three hundred cooperators will have to develop new complete soil and water conservation farm plans. In addition to the new plans, a minimum of fifty old basic soil and water conservation farm plans should

be rewritten.

In applying these plans, vegetative practices will be used in combination with structural measures in order to reduce runoff, provide protection from erosion, improve drainage and general soil conditions. Conservation cropping systems will be planned and applied so that crops will be grown on soils to which they are best adapted. Row crops, particularly soil depleting crops, will not be grown more often than soil capabilities will permit.

Other land treatment measures will include wind strip-cropping, cover and green manure crops, rotation grazing, pasture planting, wildlife habitat development, drainage laterals, tile drains, drainage field ditches, tree planting and forest land improvement work.

No significant changes in kinds of crops are expected to occur during the life of the project. However, as a result of farm planning and improved drainage, there will probably be some shifting of cultivation to more desirable open land.

The land treatment measures on forest land are designed to improve pine stands on areas where excess surface water retards pine growth and reproduction and to protect and improve good hardwood sites and stands. Water management is the principle practice recommended for forest land improvement. Water management will permit better management opportunities; make it possible to improve stands and tree quality; increase food and cover for wildlife; increase the production of forest products, and facilitate harvesting and protection activities.

The recommended measures for improving the forest land include the development of water and forest management plans, tree planting, release of desired species, and cuttings to encourage natural reseeding and improve the quality of the stands. Alternative combinations of these measures will be installed on 5,000 acres of forest land. A satisfactory water balance will have to be maintained to establish seedlings and still maintain normal growth rates on drier sites. Areas better adapted to growing wet land species should not be converted to a site which would encourage the dry site species.

The land treatment program must be planned and applied if project objectives are to be met successfully. It must also be maintained to protect and improve the land and insure the continual effective functioning of structural measures.

Structural Measures

Structural measures to be installed consist of 38.67 miles of multiple purpose channel for flood prevention and drainage. The estimated cost is $984,409 of which $723,014 will be paid from PL 566 funds and $261,395 from other funds.

Bridges will be modified and culverts replaced with bridges to provide capacity and depth of channels to meet project objectives. Spoil banks will be piled outside the berm area so that natural vegetation might be established. Pipe overfalls supported by sand-cement bag walls or spur inlets will be installed where necessary at road crossings. At other locations where con-

siderable amounts of water enter the channel, similar methods will be employed to convey the water through the spoil bank and into the channel. The system of channels is planned to accomplish the project objective and is designed to give every part of the watershed a drainage outlet either through group laterals or on-farm drainage ditches.

Channels were designed by the use of the formula, $Q = CM5/6$. A constant of 69 was used for Iron Spring Swamp, Huggins Swamp, the upper 4,283 feet of channel in Long Branch, the upper 10,250 feet of channel in Pleasant Meadow Branch, the upper 11,716 feet of channel in Mitchell Swamp and the channel in tributaries 1 and 2 to Mitchell Swamp. The remaining designs were accomplished using a constant of 45 in order to utilize available swamp storage and without interferring with project objectives.

EXPLANATION OF INSTALLATION COSTS

Land treatment measures are estimated to cost $1,871,293. The PL 566 cost of $146,247 will provide additional technical assistance needed to accelerate the planning and application of these measures. It is estimated that $25,100 is now being spent in the watershed for technical assistance by the Soil Conservation Service during an average five year period.

The cost of land treatment measures is based on average figures now being used in Horry County.

The costs of installing the forestry phase of the program were developed by the South Carolina Commission of Forestry and the U. S. Forest Service. The technical assistance costs were based on the present costs of the going Cooperative Forest Management Program. The installation costs were based on present prices paid by landowners or operators to establish individual measures in the locality. The amount of forest land treatment measures needed to meet treatment goals was based on a field survey of the watershed adjusted for expected participation during the installation period.

The installation cost of structural measures shown in Tables 1 and 2 are based on the best information obtainable but must be considered as approximate. The engineering estimate is based on unit costs arrived at by averaging figures obtained from several Soil Conservation Service engineers who are working in coastal plain areas of South Carolina. The construction cost estimate includes clearing a right-of-way, excavation of the channel and spur inlets, and a twelve percent contingency fee. The contingency fee is sufficient to include the cost of fish and wildlife mitigating features.

Installation services include the cost of geological investigation, engineering supervision, and the necessary administration for construction of the structural measures. These figures are estimated on the basis of past experience.

The cost of administration of contracts and the value of easements and rights-of-way are local costs and are included under "other" funds. The cost of the administration of contracts is an estimated figure including fiscal, clerical and legal assistance as well as office supplies required for advertising for bids, letting the contract, and administrative cost of paying for the structural measures as the work progresses.

The unit cost figures needed to determine the value of easements was furnished by the local sponsoring organizations. Changes required in bridges

and culverts to provide capacity and depth to the channel system are included in the easement and right-of-way item.

Construction cost of the multiple purpose channel improvement for flood prevention and drainage is estimated to be $745,857. Flood prevention was allocated $428,868 and drainage $316,989. (See page 30). The proposed sharing of installation costs of structural measures is $723,014 (73%) from PL 566 funds and $261,395 (27%) from other funds. This cost sharing was arrived at by first allocating costs of the multiple purpose channel improvement to the two purposes (flood prevention and agricultural water management) in accordance with the method prescribed in paragraph 1132.212h of the Watershed Protection Handbook.

For further details of cost allocations, see the Economic section of Investigation and Analyses.

In the operations stage, additional surveys and borings will be made to analyze conditions more completely and furnish a better basis for the final design of structural measures.

The expected expenditures in accordance with the anticipated schedule of operations are as follows:

Year	PL 566	Other	Total
First	$438,060	$ 325,592	$ 763,652
Second	321,516	367,065	688,581
Third	29,249	345,009	374,258
Fourth	36,562	431,261	467,823
Fifth	43,874	517,514	561,388
Total	$869,261	$1,986,441	$2,855,702

EFFECTS OF WORKS OF IMPROVEMENT

Project objectives as agreed upon by the local people are stated in the section entitled "Basis for Project Formulation".

The Mitchell Swamp-Pleasant Meadow Branch Watershed is comparatively flat. In many areas the land slopes are very slight. This results in considerable flooding whenever there is prolonged or intensive rainfall. The existing low capacity channels and drainageways cannot possibly remove the water fast enough to prevent flooding. The channel provided for in this plan will reduce the present flooding by providing major outlets to take care of excessive runoff

Structural measures will benefit 57,232 acres of land and the installation of all planned works of improvement will benefit 67,332 acres. Monetary benefits were claimed on 20,195 acres and the project is justified without increasing the acreage of crops in surplus supply.

The proposed system of main channels will provide flood prevention and drainage outlets where needed. Landowners indicate intentions of installing additional group drainage and on-farm ditches necessary for the realization of benefits. Improved drainage will facilitate more timely performance of cultural practices essential to efficient farming.

Structural measures will benefit all farms in the watershed. The benefits are primarily in the form of reduced flood damage, improved drainage, decreased production costs, increased yields of higher quality, and better

health conditions.

The installation of Structural Measures will reduce floodwater damage to public roads, culverts, and bridges from $55,440 to $13,860 annually. (Table 5) Dirt roads will receive a major benefit in the form of reduced maintenance costs. Other benefits will accrue from the all-weather use of public and farm roads which are now impassable at times due to flooding and inadequate drainage outlets.

Horry County has been designated as a Rural Areas Development County. The effects of the project on the low income farms will be significant. The installation of proposed structural works of improvement, together with group and on-farm drainage measures, will increase economic opportunities for many of the low-income families.

After project installation farm operators can make needed land use adjustments that will be more in line with capabilities and needs of the land. Changes in land use on the benefited land will not tend to increase the amount of cultivated land in the watershed. In fact, plans call for a reduction of 1,300 acres in cultivated crops.

The flood protection and drainage provided by this plan will give farmers much more flexibility in crop rotations. On many farms of the watershed tobacco has been planted in the same location year after year. This project will provide more well-drained, suitable land that will permit the systematic rotation of all crops so that soil building practices can be carried out in the watershed. These better management practices will improve the condition of the soil, reduce cultivation costs and increase returns from the land. Increased income resulting from changes brought about by this plan will make a needed contribution to the objectives of rural areas development.

Many farmers stated that the problem of inadequate outlets for farm drains hampered tobacco bed operation, prevented land preparation and delayed planting. Likewise, harvesting is often delayed and in some cases machinery cannot be used for this purpose. The lack of proper drainage has resulted in below average yields and poor quality. This project will permit more timely performance of farm operations, thus increasing farm efficiency and permitting better farm management.

The structural measures included in this plan do not extend across the State line. However, a much better outlet will be provided for the existing system of channels draining from North Carolina into South Carolina.

In addition to increasing economic opportunities for low-income families, this watershed project is expected to have a favorable influence on the economy of the local community. These secondary benefits accrue as a result of increased income from transporting, processing, and marketing of those goods and services that produce the primary benefits, and from supplying additional materials to farmers.

The installation of project measures and their operation and maintenance will also provide employment opportunities for the unemployed or under-employed labor in this area. The estimated value of redevelopment benefits were also used for project justification.

The proposed channel work is to be located in natural drainageways. There will not be any significant stage increases anywhere in these depressed

swamp areas due to the proposed system of channels.

The proposed works of improvement will adversely effect some wildlife species, have little effect upon others, and will be beneficial to most upland game species. Wood ducks will have a significant loss of habitat through the swamp drainage and also the value of the swamp as a refuge area for wildlife will be reduced. Following channelization, favorable fish habitat will cease to exist in the extreme upper portions of Mitchell Swamp and its smaller tributaries. There will also be a change in fish habitat in the lower protions of the swamp because of more swiftly moving water.

The works of improvement will not have significant effects upon game species as raccoon and opossum. As has been previously stated, these and other fur-bearers have a low value in the project area. There will be no important effect upon non-game birds.

The swamp drainage will favor squirrels through increased acorn production and will also produce conditions more favorable to squirrel hunting. The swamp drainage will provide sites for deer and wild turkey management practices if these should be desired by landowners in the future. Improved farm drainage made possible by the project will directly benefit quail and doves.

In order to mitigate and reduce losses to fish and wildlife in the project, the channel alignment will be made to avoid the swamp lakes whenever possible. Also where feasible, additional lakes will be created by plugging the ends of "ox-bows" in the present swamp runs with spoil. Outlets which might cause drainage of the by-passed lakes will be plugged. These swamp lakes comprise the more valuable fish and wildlife habitat in the swamp area of the project. Individual landowners will be encouraged to install water control devices to facilitate management of these impoundments.

The final design of the main channel has been made more shallow and the swamp itself will be used for temporary water storage during peak flows. This will allow periodic flooding of the swamp and will maintain the water level in the lakes. Part of the losses in fishing will be compensated by farm ponds planned on individual farms as a part of their Soil Conservation District plans.

Since the channel system is designed so that the depressed swamp drainage-ways will carry a part of the design capacity, the ditches so located may be expected to overflow periodically. This will prevent de-watering of the swamps and will tend to preserve existing hardwood sites in the watershed.

PROJECT BENEFITS

Direct primary benefits from crop and pasture land are estimated to total $191,610 annually. The flood prevention benefits are $99,158 from reduction of damages and $11,018 from more intensive land use. Agricultural water management benefits are estimated to be $81,434 which accrue from increased units of productions, reduced cost of production, and increased price received per unit as a result of better quality.

Floodwater damage reduction benefits to public roads, culverts, and bridges are estimated to be $41,580 annually.

This watershed is located in a Rural Areas Development County designated under the Area Redevelopment Act of 1961. Redevelopment benefits resulting from the income provided to unemployed and under-employed labor during project installation and operation and maintenance (limited to a 20-year period on O & M) are estimated to amount to $6,340 annually.

Average annual secondary benefits (not used in project justification) are estimated to be $88,533. These benefits will accrue to processors, handlers, and local business in the immediate area as a result of increased farm income. Additional secondary benefits of a more intangible nature are expected to accrue outside the immediate area of influence of the project, and will stem from increased income which, in turn, will place increased capital into circulation. These benefits will accrue to beneficiaries not readily indentifiable and are considered to be more in the nature of benefits to the public in general.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of planned structural works of improvement, including annual operation and maintenance cost, is estimated to be $61,545. Estimated average annual project benefits, excluding secondary benefits, are $239,530. The ratio of benefits to cost is 3.9 to 1.0 (Table 6).

PROJECT INSTALLATION

Land Treatment Measures

The landowners and operators will install the planned land treatment measures in cooperation with the Horry Soil Conservation District and in accordance with provisions of cooperative agreements and conservation farm

plans. The installation period will extend over a five-year period. The planned percentages of land treatment measures to be installed during each of the five installation years are as follows: first, 10 percent; second, 15 percent; third, 20 percent; fourth, 25 percent; and fifth, 30 percent.

The South Carolina Commission of Forestry, in cooperation with the U. S. Forest Service, will provide technical supervision for installing all forestry measures.

Technical assistance now being provided by the Soil Conservation Service will be supplemented with PL 566 funds to accelerate planning and application so that the project can be completed within the designated installation period.

Land treatment measures will include conservation cropping systems, cover and green manure crops, rotation grazing, pasture and hayland planting, wind strip cropping, wildlife habitat development, drainage laterals, tile drains, drainage field ditches and forest land treatment. These measures will be installed at the expense of the landowners with such financial assistance as may be available through the Agricultural Conservation Program. The present lack of drainage outlets in the watershed seriously limits the application of worthwhile conservation measures. The installation of the structural measures proposed in this plan will supply the necessary outlets thereby promoting the application of the needed land treatment on individual farms.

The landowners having forest land will be encouraged to apply and maintain the forestry measures on their forest land. The need for forest water management on each site will be jointly determined by the forester and the soil conservationist assigned to the project.

The South Carolina Commission of Forestry, in cooperation with the U. S. Forest Service, will assign a forester to the project. He will provide technical assistance to private landowners in the watershed. He will consult with the soil conservationist and engineer to determine the location of forest areas needing water management.

The nature of the project requires close contact with the landowners to help determine what land will benefit from water management. The landowners need to maintain satisfactory water level balances to establish seedlings and maintain normal growth rates. Water management practices should insure that sites which are adapted to growing wet land hardwood will not be converted to dry site species. Some technical assistance in the planning and application of forest land treatment measures will be provided under the going Cooperative Forest Management program.

Structural Measures

The channel improvement will be installed by contract administered by the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District. Plans, specifications, and the necessary engineering supervision for the installation of the structural measures will be furnished by the Soil Conservation Service. The 38.67 miles of channel improvement is in one construction unit but will be divided into two parts for the purpose of letting contracts during the first two project years.

The Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District will be responsible for obtaining all easements for the channel work prior to issuance of invitations to bid. No water rights will be involved in this project.

The Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District will be responsible for all costs incident to administration of contracts.

The structural measures to be contracted for during the first project year will include the channel improvement on Lake Swamp, Pleasant Meadow Branch and on Mitchell Swamp from the confluence with Pleasant Meadow Branch to the junction with Iron Springs Branch.

The remaining channel on Mitchell Swamp with two laterals at upper end, Long Branch, Iron Springs Branch and Huggins Swamp will be constructed during the second year.

FINANCING PROJECT INSTALLATION

Federal Assistance

Financial assistance for technical services and for cost sharing will depend on the availability of PL 566 funds. All easements must be obtained prior to advertising for bids. Other requirements are that the local part of funds be available for cost-sharing, that Operation and Maintenance agreements be executed, and that the Mitchell Swamp-Pleasant Meadow Branch Watershed District be prepared to discharge its responsibilities as a contracting agency.

Land Treatment Measures

All land treatment measures are to be installed on private lands and will be paid for by the individual landowners with assistance as may be available from the Agricultural Stabilization and Conservation Service. Technical Assistance for installing the forestry measures will cost $11,000. This will be financed with $6,300 of PL 566 funds, $4,200 provided by the South Carolina Division of Forestry, and services valued at $500 to be provided under the going Cooperative Forest Management Program. Cost-sharing rates in similar programs will determine the cost-sharing rate during the remainder of the installation period. The present Cooperative Forest Management Program will continue throughout the period.

Soil Conservation Service will provide additional technical assistance from PL 566 funds to accelerate planning and application of land treatment in the watershed.

Structural Measures

Federal assistance for establishing the works of improvement as described in this plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (PL 566), as amended and the "other" share of the cost will be the responsibility of the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District. Negotiations are underway with the Farmers Home Administration for a loan to cover the local cost. It is planned that the loan will be secured by a tax levy on real property

in the watershed and a referendum to permit this levy has already been voted on favorably. Landowners have indicated verbally their intentions to donate the necessary easements. Horry County and the South Carolina State Highway Department are expected to make required changes in bridges and culverts at their own expense.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by the farmers on whose lands they are located in accordance with the provisions of their conservation farm plans with the Horry Soil Conservation District. Forestry technical assistance required for operating and maintaining the forestry measures will be provided by the going Cooperative Forest Management Program.

Structural Measures

Structural measures to be operated and maintained consist of 38.67 miles of multiple purpose channel.Maintenance such as removing debris from channel, suppressing undesirable vegetation with chemicals, and periodic clean-outs of the mains and laterals will be performed by the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District with funds realized from a tax levy on real property or from other sources. It is expected that Horry County will make labor and equipment available for some of the maintenance work on the channels.

The responsibility for all maintenance on structural measures will be assumed by the Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District. Specific maintenance agreements will be executed between the Watershed District and the Soil Conservation Service prior to the issuance of invitation to bid for the construction of structural measures. The estimated average annual cost for operation and maintenance of all structural measures is $22,375 (Table 4).

Joint inspections of structural measures by representatives of the Soil Conservation Service and the local sponsoring organizations will be made at least once each year or after each major storm, whichever is more often. The Mitchell Swamp-Pleasant Meadow Branch Watershed Conservation District will maintain a record of operation and maintenance inspections in their files. These reports will be made available to interested persons on request. The Soil Conservation Service representative making inspections will prepare a written narrative setting forth his findings.

The South Carolina Commission of Forestry, in cooperation with the U. S. Forest Service, will furnish technical assistance to operate and maintain forestry measures on private lands.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/		
		Non-Fed. Land	PL 566 Funds	Other	Total
			Non-Fed. Land	Non-Fed. Land	
(1)	(2)	(3)	(4)	(5)	(6)
Land Treatment					
Soil Conservation Service					
Cropland	Ac.	17,300		1,506,456	1,506,456
Grassland	Ac.	1,300		143,390	143,390
Miscellaneous	Ac.	100		2,500	2,500
Technical Assistance			139,947	25,100	165,047
SCS Subtotal			139,947	1,677,446	1,817,393
Forest Service					
Woodland	Ac.	2,226		42,900	42,900
Technical Assistance			6,300	4,700	11,000
FS Subtotal			6,300	47,600	53,900
TOTAL LAND TREATMENT			$146,247	$1,725,046	$1,871,293

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST (CON'T.)

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/		
		Non-Fed. Land	PL 566 Funds	Other	Total
			Non-Fed. Land	Non-Fed. Land	
(1)	(2)	(3)	(4)	(5)	(6)
STRUCTURAL MEASURES					
Soil Conservation Service					
Stream Channel Improvements	Mi.	38.67	587,362	158,495	745,857
SCS Subtotal			587,362	158,495	745,857
Subtotal - Construction			587,362	158,495	745,857
Installation Services					
Soil Conservation Service					
Engineering Services			66,594	--	66,594
Other			69,058	--	69,058
SCS Subtotal			135,652	--	135,652
Subtotal - Installation Services			135,652	--	135,652
Other Costs					
Land, Easements & R/W			--	99,900	99,900
Administration of Contracts			--	3,000	3,000
Subtotal - Other			--	102,900	102,900
TOTAL STRUCTURAL MEASURES			723,014	261,395	984,409
TOTAL PROJECT			869,261	1,986,441	2,855,702
SUMMARY					
Subtotal SCS			862,961	1,938,841	2,801,802
Subtotal FS			6,300	47,600	53,900
TOTAL PROJECT			869,261	1,986,441	2,855,702

1/ Price base 1963

Date Aug. 1964

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Item	Unit	Applied to Date	Total Cost (Dollars) 1/
(1)	(2)	(3)	(4)
Conservation Cropping Systems	Ac.	9,366	9,366
Cover and Green Manure Crop	Ac.	4,500	47,250
Rotation Grazing	Ac.	750	7,500
Pasture and Hayland Planting	Ac.	1,500	60,000
Wind Strip Cropping	Ac.	100	500
Wildlife Habitat Development	Ac.	200	5,000
Tree Planting	Ac.	1,200	22,800
Woodland Harvest Cutting	Ac.	900	9,000
Tile Drains	Ft.	150,000	57,000
Drainage Field Ditch	Ft.	689,000	275,600
Total			494,016

1/ Price Base - 1963.

Date Aug. 1964

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

(Dollars) 1/

Structure Site No. or Name	Installation Cost-P.L. 566 Funds				Installation Cost - Other Funds					Total Inst. Cost
	Construction	Instal. Services		Total P. L. 566	Construction	Installation Services	Other		Total Other	
		Engineering	Other				Adm. of Contracts	Easements & R/W		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Stream Channel Improvement	587,362	66,594	69,058	723,014	158,495	-	3,000	99,900	261,395	984,409
GRAND TOTAL	587,362	66,594	69,058	723,014	158,495	-	3,000	99,900	261,395	984,409

1/ Price base: 1963

2/ Includes $49,200 for altering road culverts and bridges and $700 for telephone cable changes.

Date Aug. 1964

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

(Dollars) 1/

Item	Purpose		Total
	Flood Prevention	Drainage	
(1)	(2)	(3)	(4)
	COST ALLOCATION		
Multiple Purpose Channel Improvement	566,036	418,373	984,409
Total	566,036	418,373	984,409
	COST SHARING		
P. L. 566	506,868	216,146	723,014
Other	59,168	202,227	261,395
Total	566,036	418,373	984,409

1/ Price base: 1963 Date Aug. 1964

TABLE 3 - STRUCTURE DATA

CHANNELS

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Channel Designation	Sta. Numbering for Reach Sta.	Sta.	Water-shed Area	Required Channel Capacity	Planned Channel Capacity	Bottom Width	Depth	Slopes	"N" Value	Vel. in Channel	Volume Exc.
			(sq.mi)	(CFS)	(CFS)	(Ft.)	(Ft.)	(ft/ft)		(ft/sec)	(cu.yds)
Mitchell Swamp	0+00	52+50	3.5	196	202	7	8	.00095	.045	2.3	
(County Road)	52+50	75+83	9.0	441	446	14	8	.00095	.040	3.1	
(Confl.Trib.#1)	75+83	117+16	9.8	461	446	14	8	.00095	.040	3.1	
	117+16	128+83	10.0	310	446	14	8	.00095	.040	3.1	
(Hwy. 140)	128+83	165+50	11.4	342	446	14	8	.00095	.040	3.1	
(County Road)	165+50	193+33	11.9	357	384	14	9	.00044	.040	2.3	
	193+33	218+00	27.3	710	797	26	9	.00044	.035	2.9	
(Confl.Huggins Sw)	218+00	236+33	27.4	712	797	26	9	.00044	.035	2.9	
(County Road)	236+33	261+33	28.0	728	797	26	9	.00044	.035	2.9	
	261+33	320+00	32.1	803	879	28	9	.00044	.035	3.0	
(Hwy. 178)	320+00	368+00	35.5	888	879	30	9	.00044	.035	3.0	
	368+00	420+33	37.5	938	1,020	32	9	.00044	.035	3.1	
(Hwy. 410)	420+33	477+83	48.8	1,122	1,128	36	9	.00044	.035	3.1	
(Confl.Iron Spring	477+83	534+50	50.0	1,150	1,156	37	9	.00044	.035	3.1	
Swp.)	534+50	566+17	50.3	1,157	1,220	60	9	.00044	.035	2.1	
(County Road)	566+17	592+84	62.2	1,431	1,476	70	9	.00018	.035	2.2	
(Confl.Long Br.)	592+84	658+17	64.3	1,433	1,476	70	9	.00018	.035	2.2	
(State Hwy. 917)	658+17	703+17	65.6	1,443	1,514	72	9	.00018	.035	2.2	
(Confl. Pleas.	703+17	723+11	99.9	2,098	2,070	100	9	.00018	.035	2.2	
Meadow Br.)	723+11	786+44	114.2	2,236	2,369	110	9	.00018	.035	2.3	
	786+44	841+44	117.3	2,246	2,369	110	9	.00018	.035	2.3	
(Hwy. 19)	841+44	901+11	122.3	2,250	2,369	110	9	.00018	.035	2.3	
(Outlet)	901+11	916+11	122.7	2,260	2,369	110	9	.00018	.035	2.3	744,300
Pleasant Meadow	0+00	45+00	5.2	270	298	8	8	.00150	.045	3.1	
Swamp(Hwy. 43)	45+00	102+50	14.1	620	629	16	9	.00090	.040	3.4	
	102+50	168+33	17.1	479	629	16	9	.00090	.040	3.4	

TABLE 3 - STRUCTURE DATA (CON'T.)

CHANNELS

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Channel Designation	Sta. Numbering for Reach Sta.	Sta.	Water-shed Area (sq.mi)	Required Channel Capacity (CFS)	Planned Channel Capacity (CFS)	Bottom Width (Ft.)	Depth (Ft.)	Slopes (ft/ft)	"N" Value	Vel. in Channel (ft/sec)	Volume Exc. (cu.yds)
Pleasant Meadow Swamp (Con't.)											
(County Road)	168+33	194+16	17.3	484	486	20	9	.00035	.040	2.2	
	194+16	219+16	22.4	605	632	26	9	.00035	.040	2.3	
	219+16	234+99	22.9	618	632	26	9	.00035	.040	2.3	
	234+99	300+82	28.8	750	759	28	9	.00035	.035	2.6	
(Hwy. 410)	300+82	351+16	30.9	773	759	28	9	.00035	.035	2.6	
	351+16	392+83	32.5	813	839	30	9	.00035	.035	2.7	
(Confl.Mitchell Swp)	392+83	442+83	33.8	845	839	30	9	.00035	.035	2.7	234,700
Long Branch	0+00	15+00	2.3	138	156	5	7	.00150	.045	2.6	
(Hwy. 306)	15+00	42+83	4.2	227	267	8	7	.00150	.040	3.3	
	42+83	75+83	4.9	172	267	8	7	.00150	.040	3.3	
	75+83	117+50	7.1	234	267	8	7	.00150	.040	3.3	
(Hwy. 9)	117+50	139+50	7.6	251	256	10	7	.00095	.040	2.7	
	139+50	181+10	10.6	322	357	14	7	.00095	.040	2.9	
(Confl.Mitchell Swp)	181+10	226+77	11.7	351	357	14	7	.00095	.035	2.9	26,650
Iron Spring	0+00	42+50	1.4	88	113	3	7	.00180	.045	2.5	
(Hwy. 306)	42+50	103+34	6.9	345	342	10	7	.00180	.040	3.6	
	103+34	173+34	8.2	402	397	12	8	.00100	.040	3.1	
	173+34	181+67	8.7	426	461	14	8	.00100	.040	3.2	
(State Hwy. 9)	181+67	200+00	9.0	432	461	14	8	.00100	.040	3.2	
(Confl.Mitchell Swp)	200+00	226+67	9.2	442	461	14	8	.00100	.040	3.2	44,050
Huggins Swamp	0+00	35+00	6.9	345	397	12	8	.00100	.040	3.1	
(Hwy. 306)	35+00	115+83	12.6	567	598	18	8	.00100	.040	3.4	
(Confl.Mitchell Swp)	115+83	130+83	12.7	572	598	18	8	.00100	.040	3.4	75,900

TABLE 3 - STRUCTURE DATA (CON'T.)
CHANNELS

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina

Channel Designation	Sta. Numbering for Reach		Water-shed Area	Required Channel Capacity	Planned Channel Capacity	Bottom Width	Depth	Slopes	"N" Value	Vel. in Channel	Volume Exc.
	Sta.	Sta.	(sq.mi)	(CFS)	(CFS)	(Ft.)	(Ft.)	(ft/ft)		(ft/sec)	(cu.yds)
Tributary No. 1	0+00	31+67	1.0	69	140	3	8	.00150	.045	2.5	
(County Road)	31+67	50+00	5.2	276	290	7	8	.00150	.040	3.3	
(Confl.Trib.# 2)	50+00	56+67	5.2	276	290	7	8	.00150	.040	3.3	
(Confl.Mitchell Sw)	56+67	70+00	5.2	276	290	7	8	.00150	.040	3.3	11,470
Tributary No. 2	0+00	28+33	4.0	220	237	7	8	.00100	.045	2.7	6,610

NOTE: Required drainage curve Q=69M5/6 for Iron Spring, Huggins Swamp, above Sta. 117+16 on Mitchell Swamp, above Sta. 102+50 on Pleasant Meadow Swamp and above Sta. 42+83 on Long Branch. Required drainage curve Q = 45M5/6 on the remaining portions of the channels.

Side Slopes = $\frac{1}{2}$:1 (See "Soils" on Page 3).

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TABLE 4 - ANNUAL COST

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina
(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
(1)	(2)	(3)	(4)
Channel Improvement	39,170	22,375	61,545
Total	39,170	22,375	61,545

1/ Price base: 1963. Amortized at 3 1/8 percent interest rate for 50 years.

2/ Long-term prices.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina
(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Agricultural crop and Pasture	123,950	24,792	99,158
Non-agricultural (public roads)	50,400	12,600	37,800
Subtotal	174,350	37,392	136,958
Indirect	5,040	1,260	3,780
Total	179,390	38,652	140,738

1/ Price base: Long-term projected.

Date Aug. 1964

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Mitchell Swamp-Pleasant Meadow Branch Watershed, South Carolina
(Dollars) 1/

Evaluation Unit	AVERAGE ANNUAL BENEFITS					Avg. Annual Cost	Benefit Cost Ratio
	Flood Prevention		Agr.Water Mgt.	Re-development	Total		
	Damage Reduction	More Intensive Land Use	Improved Efficiency 2/				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Channel Improvement	140,738	11,018	81,434	6,340	239,530	61,545	3.9 to 1.0
GRAND TOTAL	140,738	11,018	81,434	6,340	239,530	61,545	3.9 to 1.0

1/ Price base: Benefits and Operation and Maintenance costs are long-term projected costs; 1963 prices.

2/ Includes increased units of production, reduced cost per unit and increased price received as a result of improved quality.

Date Aug. 1964

INVESTIGATIONS AND ANALYSES

Land Use and Treatment

The existing pattern of land use was determined from soil conservation surveys and from field studies. Estimates of future land use and treatment measures were made by the work unit conservationist on the basis of his knowledge of the people, the land, and present trends in the watershed area. Land capabilities and needs were considered in arriving at the land treatment measures planned for the watershed.

Forestry

A field survey by personnel of the U. S. Forest Service determined forestry conditions and treatment needs. This information together with data from other agencies, and assistance from other forestry officials determined the amount and type of remedial measures in woodlands. The forest land treatment measures planned are limited by the expected participation and the length of the installation period.

Engineering

Mean sea level datum was used for vertical control throughout the watershed. Temporary bench marks were established in appropriate places while making the field surveys. These bench marks were located and numbered on aerial photographs and on a watershed map.

Elevations of the swamp and adjacent fields were established approximately one-half to three-fourths mile apart on all of the planned channels. Control points, such as bridges, culverts and low field areas were established. Distances were measured from aerial photographs. Profiles of the planned channels were made for preliminary design as outlined in the National Engineering Handbook, section 16, chapter 6. Photo mosaics were used for layout of the planned structural measures.

All data has been recorded and filed for final layout and design of the channels.

Geologic

The general geology was determined through study of available publications and a reconnaissance of the area. A very limited amount of time available did not permit any detailed studies. Hand augers and probes were employed to determine the general nature of soil materials in the swamps where channel enlargement is planned. A number of soundings at locations of known elevation indicates a general distribution of a very fine grained, poorly graded sand which underlies a mixture of sand and clay. In general, this "running sand" appears to lie at sufficient depths to permit excavation of channels without a great deal of difficulty. This sand may pose some considerable problems during excavation of tributaries 1 and 2, near Howard. There also exists the possibility that a detailed study would reveal some reaches in the major swamps where the presence of the sand would make it desirable to obtain the required capacity through more horizontal and less vertical excavation than is proposed in this plan.

Inasmuch as damage from sediment is negligible, rates of erosion obviously are quite low, and sediment storage for such purposes as maintaining flood storage requirements is not required, no sedimentation rates were developed.

Hydraulic and Hydrology

Elevation-discharge curves for each of fifteen valley cross-sections and thirty-three spot elevations were taken in the swamp and adjacent fields. It was found that the present capacity of the channel was so small that it could be disregarded.

The present and future weighted average soil cover complex curve number for the watershed was calculated from information obtained from the area soil scientist, local soil conservationist and U. S. Forest Service.

Daily rainfall amounts for the rain gage at Conway, S. C. were tabulated from the U. S. Weather Bureau publication "Climatological Data". An array of the largest runoff producing rain for each year was made. Runoff amounts for this array were determined by using the future weighted average curve number for the watershed and from this a runoff frequency curve was plotted.

To meet the project objective of uniform five year level of protection, the coefficient "c" for the formula $Q = CM5/6$ was computed and found to be sixty-nine. This will provide a removal rate of 2.55 inches runoff in twenty-four hours from a one square mile area. From a study of the various cross-sections it was found that in certain areas there was sufficient temporary storage in the swamp area to allow a coefficient "c" of forty-five to be used and still give the desired level of protection. For a detail of these areas see Table 3. Design discharges were determined on these bases to facilitate channel design.

Two rainfalls, 7.50 inches and 4.20 inches, of a 12 hour duration and normal moisture conditions were routed through the present and future channel systems and to a point approximately 31,000 feet below the watershed boundary to determine if there would be adverse effects from the proposed channel improvement. It was found that at the lower end of the watershed there would be a stage increase of 0.83 foot and 0.51 foot and at a point approximately 31,000 feet below the watershed there would be a stage decrease of 0.10 foot and 0.0 foot. The capacity of the swamp into which these channels drain provides an adequate outlet for the system.

Economic

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service in benefit-cost evaluations on land and water resource projects. Basic data were obtained from local farmers, agricultural workers, experiment stations, and Department of Agriculture publications.

Long-term projected prices were derived from data furnished by the Agricultural Research Service and Agricultural Marketing Service, dated September 1957. Projected prices were used in all benefit computations as well as for operation and maintenance costs. Present (1963) prices were used for installation costs. The cost of all structural measures was amortized over a 50 year period, using an interest rate of 3 1/8 percent.

Land use and yield information used in the economic evaluation was obtained from interviews with farmers who operate approximately 16 percent of the affected open land in the watershed. Available soil maps and conservation plans were used in connection with these interviews. This information was evaluated for reasonableness and summarized. This information was also checked with data from the County Agricultural Stabilization and Conservation Service office to see if the sample correctly represented the alloted crops in the watershed.

The estimated value of land, easements, and rights-of-way for structural measures is $99,900. Included in this amount is $2,000 for legal fees and local time spent in obtaining and recording easements and $49,200 for the cost of altering road culverts and bridges. The estimated value of land was furnished by the local organizations. The South Carolina State Highway Department provided basic data for cost estimates of altering road culverts and bridges.

Flood prevention and agricultural water management benefits to crops and pasture were estimated on the basis of the difference in net returns with and without the project. These benefits were allocated to flood prevention and to agricultural water management in the same proportion that costs were allocated. (57.5 percent to flood prevention and 42.5 percent to agricultural water management).

Based on an analysis of storm frequencies on this watershed it is estimated that the five year level of protection will reduce floodwater damage to crops and pasture 80 percent. Protection will induce some farmers to increase production inputs and allow them to perform operations in a more timely manner. Therefore, based on studies of crop and pasture budgets, it is estimated that more intensive land use benefits represent about 10 percent of the total flood prevention benefits to crop and pasture land.

Benefits to public roads were estimated on the basis of information obtained from Highway and County officials. Indirect damages were estimated to be 10 percent of road and bridge damage.

Secondary and Redevelopment benefits were estimated in accordance with provisions in Watersheds Memorandum SCS-57, dated October 3, 1962 and the Economics Guide. Secondary benefits were not used for project justification.

The construction cost of multiple purpose structural measures for flood prevention and agricultural water management were allocated to each purpose in accordance with the method prescribed in paragraph 1132.212h of the Watershed Protection Handbook as follows:

(1) A portion of multiple purpose costs was allocated to flood prevention equivalent to the ratio of non-wet land to total area served by multiple purpose channels.

(2) The remaining costs were considered as joint cost and were allocated equally between flood prevention and agricultural water management.

These steps provided the following percentages:

a. Percent non-wet land is of total	15
b. Percent Joint cost is of total	85
c. One-half of joint cost (%)	42.5
d. Percent cost allocated to flood prevention	57.5
e. Percent cost allocated to agricultural water management	42.5

(3) Estimated construction cost of multiple purpose channel $745,857

(4) Amount of construction cost allocated to flood prevention (57.5% of $745,857) $428,868

(5) Amount of construction cost allocated to agricultural water management (42.5% of $745,857) $316,989

Details of cost-sharing arrangements are as follows:

Multiple Purpose	P. L. 566	Other	Total
Construction cost (F.P.)	$428,868	$ 0	$428,868
Construction cost (A.W.M.)	158,494	158,495	316,989
Installation Services			
Engineering	66,594	0	66,594
Other	69,058	0	69,058
Administration of Contracts	0	3,000	3,000
Land, Easements, & R/W	0	99,900	99,900
Total	$723,014	$261,395	$984,409

Fish and Wildlife

A study was made of possibilities for mitigating fish and wildlife habitat losses resulting from the works of improvement. The principal mitigating measure proposed for this purpose was to provide means of retaining water in the swamp during periods of the year when maximum flood control and drainage capacity is not required for agricultural land.

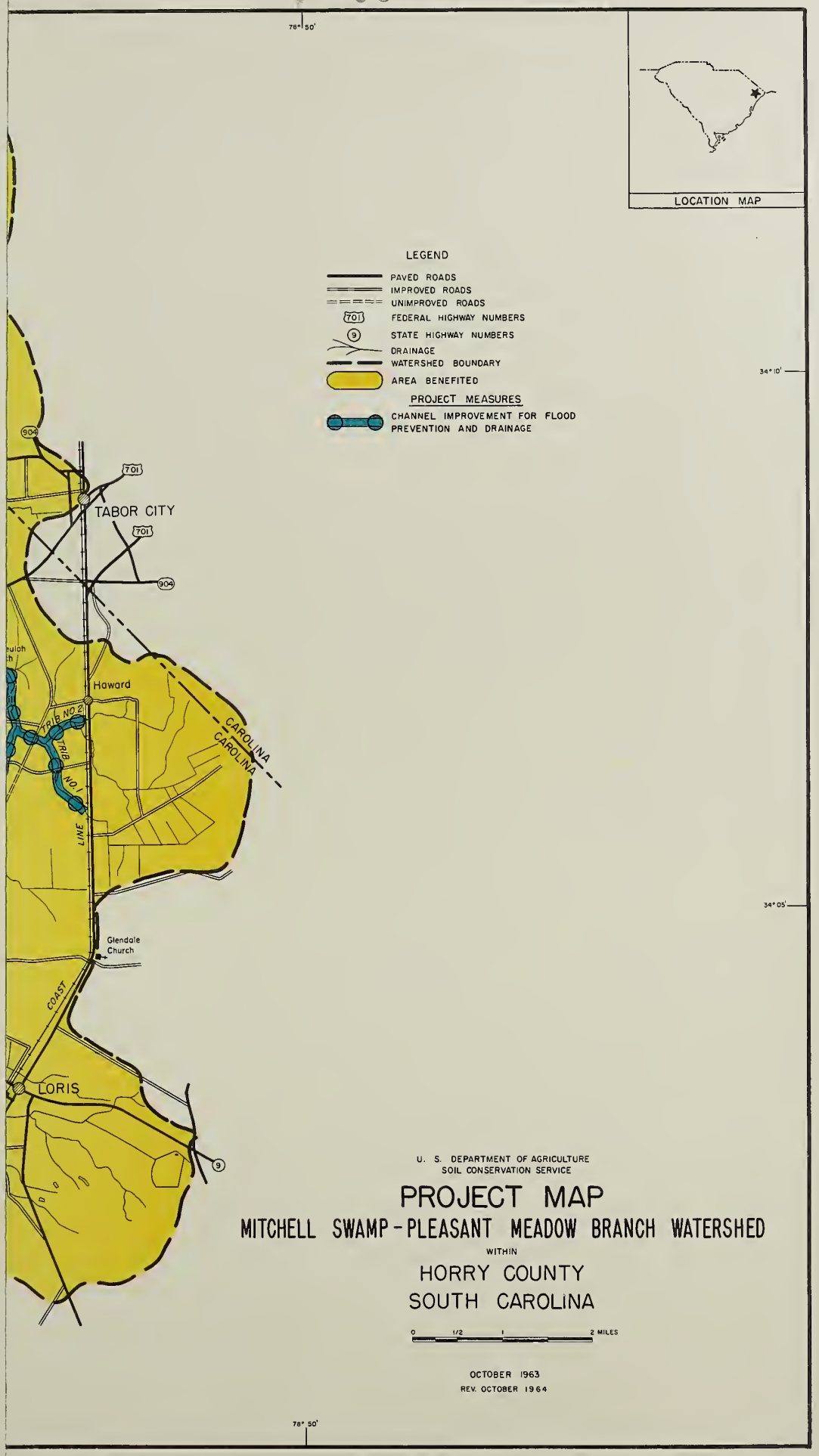
One method for such water retention which was considered was by the use of inflatable rubber dams across the channels. Although these might have some application for water control on an individual farmer's lands, their use as a part of the project installation was deemed to be of such a temporary nature and so subject to vandalism as not to be worthwhile.

The only engineeringly sound and permanent method of water retention in the swamp when desired was determined to be by the use of concrete weirs fitted with metal gates and installed with suitable earthen embankments. It was found that 11 such structures would be required for the proposed water retention in the swamp area of the project. The total cost of these structures was determined to be approximately $156,000.

An alternative was investigated which involved the use of three structures at the lower end of the project area. The thinking here was that structures located in this portion would make possible water retention over the largest acreage of swamp habitat per structure. With the broad swamp areas at the lower end, the three structures would represent control over more than one-half of the swamp area involved in the project.

In this instance, three structures would be so located as to make possible water retention in Lake Swamp and the lower end of Mitchell Swamp and Pleasant Meadow Branch. The cost of these three structures was determined to be approximately $80,000.

In lieu of the costly alternatives described above the sponsors chose to include in the plan the mitigating measures previously described. These consist of shallowing the main channel and preserving the swamp lakes where feasible.


78° 50'
LOCATION MAP
LEGEND
PAVED ROADS
IMPROVED ROADS
UNIMPROVED ROADS
701 FEDERAL HIGHWAY NUMBERS
9 STATE HIGHWAY NUMBERS
DRAINAGE
WATERSHED BOUNDARY
AREA BENEFITED
PROJECT MEASURES
CHANNEL IMPROVEMENT FOR FLOOD PREVENTION AND DRAINAGE
34° 10'
34° 05'
904
701
TABOR CITY
701
904
Howard
TRIB NO 2
TRIB NO 1
CAROLINA
CAROLINA
LINE
Glendale Church
COAST
LORIS
9
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PROJECT MAP
MITCHELL SWAMP - PLEASANT MEADOW BRANCH WATERSHED
WITHIN
HORRY COUNTY
SOUTH CAROLINA
0 1/2 1 2 MILES
OCTOBER 1963
REV. OCTOBER 1964
78° 50'

MR64-268

LEGEND

- PAVED ROADS
- IMPROVED ROADS
- UNIMPROVED ROADS
- FEDERAL HIGHWAY NUMBERS
- STATE HIGHWAY NUMBERS
- DRAINAGE
- WATERSHED BOUNDARY
- AREA BENEFITED

PROJECT MEASURES

- CHANNEL IMPROVEMENT FOR FLOOD PREVENTION AND DRAINAGE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PROJECT MAP

MITCHELL SWAMP - PLEASANT MEADOW BRANCH WATERSHED

WITHIN

HORRY COUNTY
SOUTH CAROLINA

OCTOBER 1963
REV OCTOBER 1964

Latitude and Longitude Lines Are Approximate